Manajemen Konstruksi

Project Life Cycle

Lecture 2
Ferdinand Fassa

Outline

A. *Review Lecture 1*
B. *Project & Project life cycle*
C. Project Initiation (Tahapan perencanaan dalam daur hidup proyek)
D. Feasibility Study (Studi kelayakan)
E. Preliminary engineering and design (Perencanaan umum)
F. Detail Engineering Design (Perencanaan Teknik)
G. Technical Specification
H. Discussion

A. Review Pertemuan 1

1. What is the role of the owner, Designer and engineer, and also construction manager on a construction project (minimum 3 roles) ?
2. Name two construction associations offer voluntary certification programs for construction managers in Indonesia
3. Identify at least three characteristics that make the construction project unique from other industry sector projects.
4. Why the construction project unique from other industry sector projects? (Stated clearly)
5. What advantages do you see in consolidating the roles of owner, designer and engineer, contractor? What disadvantages could it have?

B. WHAT IS A PROJECT?

Definition of a Project

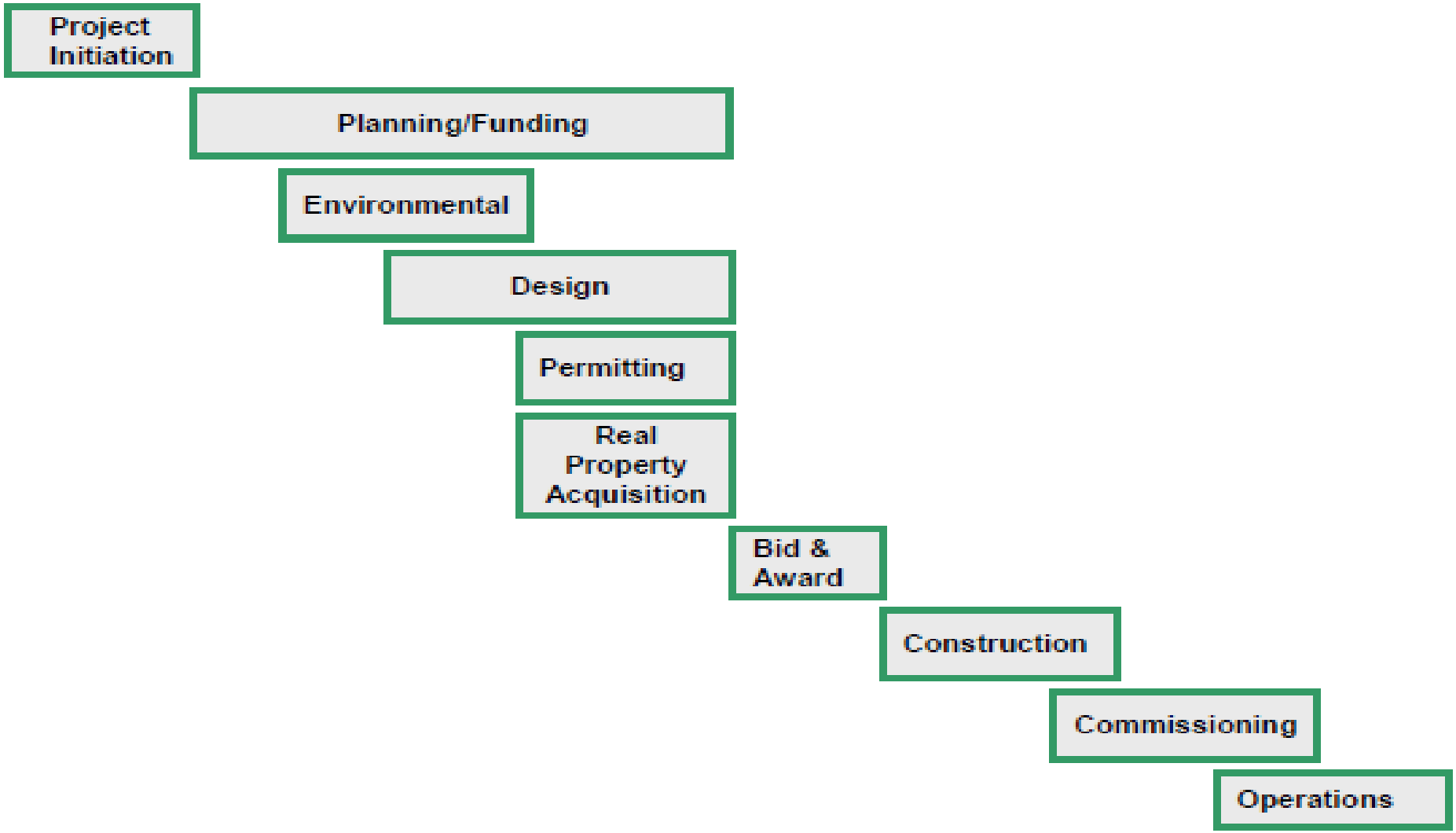
A project is made up of a group of interrelated work activities constrained by a **specific scope, budget, and schedule** to deliver capital assets needed to achieve the strategic goals of an Agency.

Construction Project Management Handbook
Federal Transit Administration (FTA), 2007

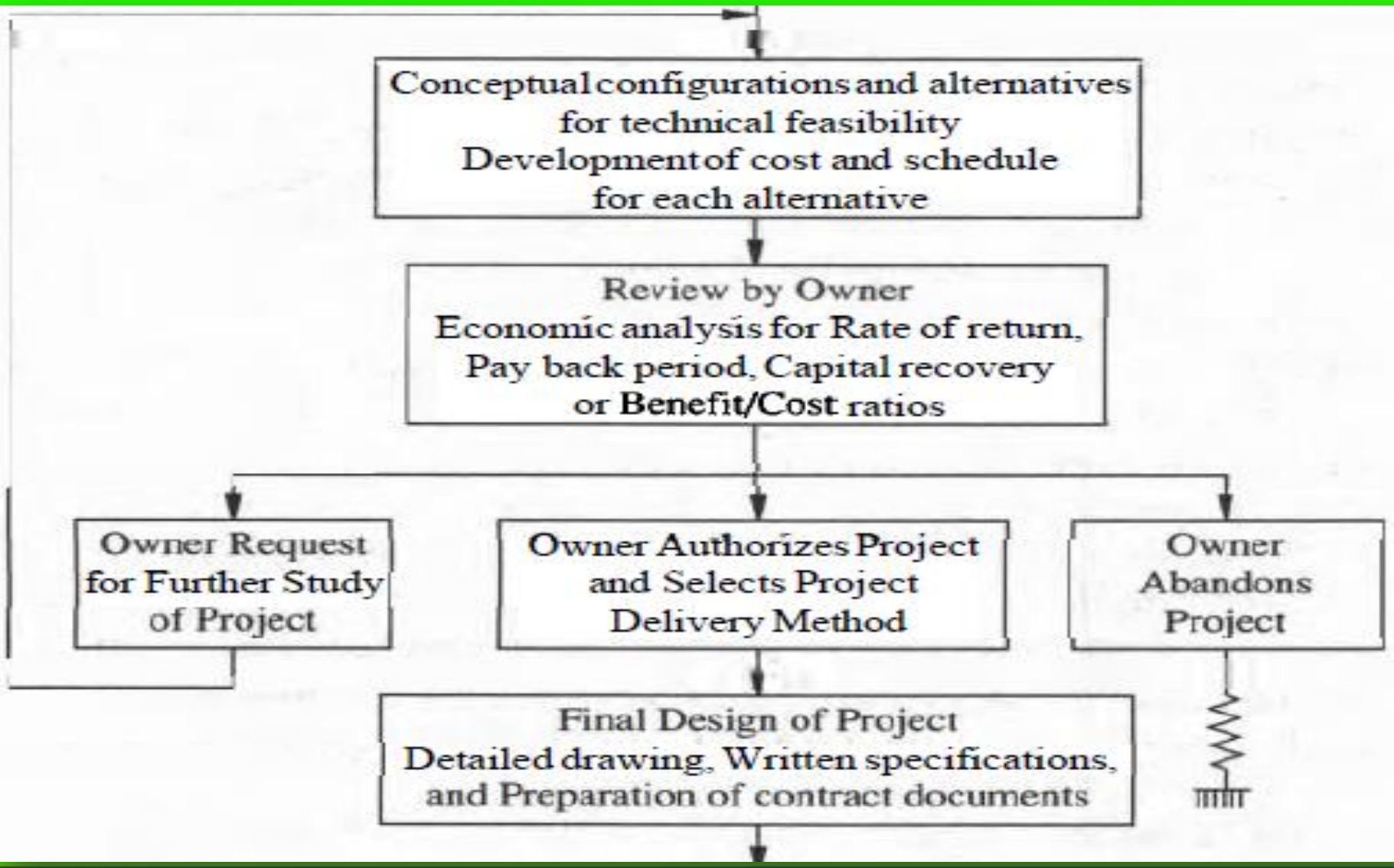
B. Project Life Cycle Phases

Project life cycle phases for a typical construction project are initiation, planning, design, construction, commissioning, and closeout.

Project Life Cycle Phases



Project Initiation



C. Project Initiation

In a traditional design/bid/build (D/B/B) project, the project life cycle begins with the initiation of planning and design

The design phase continues through the preliminary engineering effort to further analyze, validate, and define the preferred alternative and arrive at the baseline scope, budget, and schedule.

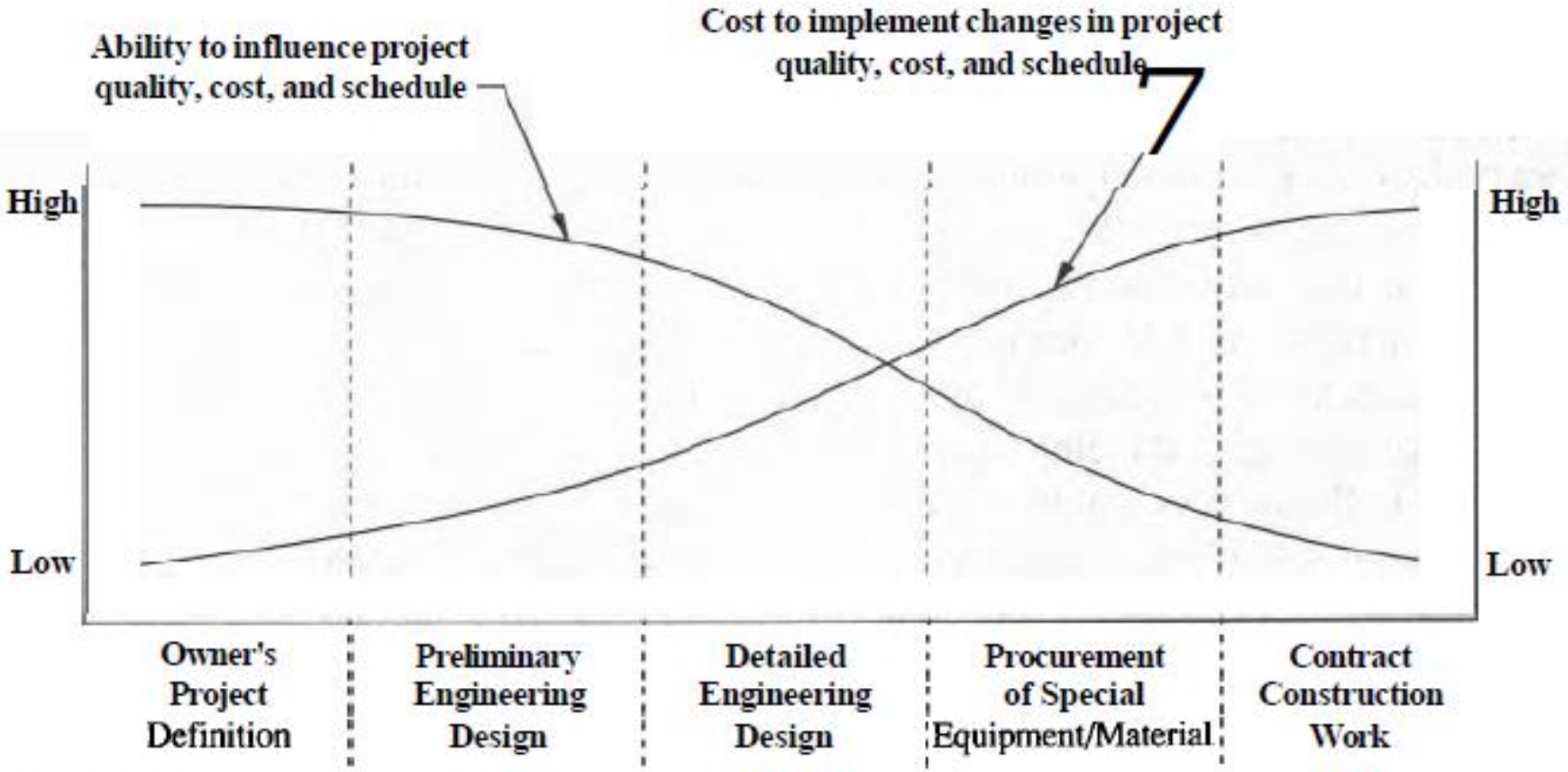


FIGURE 3-3
Importance of Clear Project Definition During the Early Phases of a Project.

D. Feasibility Study

The first step in any project is conceptual definition and refinement of the facility that will meet that need.

FS consist of:

- Construction Size
- Site Location
- Availability of labor
- Supporting resources (raw material, energy, water, etc)
- Environmental impact
- Access connection
- Convenient communication
- Sociological and economic impact on the community

E. Preliminary engineering and design

These phases are traditionally the **domain of architects and design-oriented engineers**

The design stressed on architectural concept, evaluation of technological process alternatives, size and comparative economic studies.

It evolve directly from the concept and feasibility stage

F. Detail Engineering Design

Detailed Design is broken into seven phases:

1. Scope Definition and Engineering Execution Strategy
2. Commencement of Detailed Design
3. Initial Design Development and Hazard Identification
4. Initial Design Review & Audit
5. Approval for Design (AFD)
6. Approval for Construction (AFC)
7. Design Close-Out

Detail Engineering Design

Phase 1:

Scope Definition and Engineering Execution Strategy

Preparation for commencement of detail design. To evaluate FEED(Front End Engineering Design) deliverables to ensure engineering is sufficiently mature for detail design to progress in a controlled and minimal change environment. To confirm Engineering Execution Plan.

Activities / Deliverables		Description	Key Discipline	Supporting Documentation
1	Engineering Execution Strategy	Review / confirm Engineering Execution Strategy, e.g. execution locations, workshare, disciplines required, specialist support, etc.	Project Manager and Project Engineering Manager	Tender documentation, Project Execution Plan (PEP)
2	Feed / BoD Validation	Confirm maturity of Front End Engineering Design. Identify any areas of concern and ensure these are captured on the Technical Risk Register.	Project Engineering Manager	
3	Project Baseline Standards	Establish which codes, standards and specifications are to be utilised, eg. Corporate, project, client, and confirm procedure. Include in Engineering Execution Plan and / or Discipline Job Design Specifications.	Project Engineering Manager	Engineering Baseline Standards, Document No. OAG-X160-190-GDL-012 (previously AOD-92-043)
4	Engineering Audit Schedule	Create formal schedule to identify when technical integrity audits, design reviews, HAZIDS, HAZOPS, etc are to be carried out. Align to Level 3 Engineering Plan and include in Engineering Execution Plan.	Project Engineering Manager	Technical Safety Events Schedule (Lead Technical Safety Engineer)
5	Engineering Execution Plan & Engineering Organisation Chart	Create Engineering Execution Plan complete with key supporting documents / information.	Project Engineering Manager	
6	Integrated Engineering Systems	Agree engineering design tools to be used and confirm that system hardware, software and support is available. Include issues such as PDMS or PDS, Cats and Specs, survey methods, dimensional control techniques, etc. Document and record in the Engineering Execution Plan and discipline job design specifications.	Engineering Systems and All Disciplines	Engineering Systems Project Start-up Manual, Document No. OAGX160-170-MAN-002
7	QRA & FRA Strategy	Establish status of project Quantitative Risk Assessment (QRA), Fire Risk Assessment (FRA) and Emergency Escape & Rescue Assessment (EERA) information and confirm methadology for timely delivery into engineering design process. Agree accountability for delivery, eg. Client, 3rd party, AMEC, and record in Engineering Execution Plan.	Technical Safety	Hazard Management Philosophy, OAG-X160-190-GDL-009 (previously AOD-97-001): Hazard & Risk Management, OAG-X160-190-PRO-024

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8	Discipline Job Design Specification	Define the key project specific design parameters and operational constraints that are applicable to the appropriate discipline for the detailed design of the project. To identify key individuals, roles and responsibilities, design tools, key codes and standards, etc.	All Disciplines	
9	Level 3 Engineering Plan	Agree work breakdown structure, develop CTRs and create level 3 integrated engineering plan covering all disciplines. To be included in Engineering Execution Plan.	All Disciplines	
10	Confirm CE Compliance Strategy	Review and confirm strategy for CE Compliance . Ensure discipline Lead Engineers are aware of their responsibilities and appropriate resources / measures are in place.	Project Engineering Manager	Corporate CE Compliance Strategy OAG-X160-190-MAN-001; Project Compliance with Pressure Equipment Regulations OAG-X160-050-PRO-001; Pressure Equipment Regulations Guidelines AOD-97-047; ATEX Guidelines, OAG-X160-190-GDL-003; Machinery Directive Guidelines, O&G-ENG-REP-29-001; Electromatic Compatibility Regulations Guidelines, OAG-X160-190-GDL-003; MC, The Electrical Equipment (Safety) Regulations Guideleines, OAG-X160-190-GDL-003.
11	Technical Risk Register	Create formal Technical Risk Register identifying all possible risks asscociated with the engineering design.	Technical Safety	

Detail Engineering Design

Phase 2:

Commencement of Detailed Design

To formally kick off the Engineering Design Process in accordance with the project execution plan and to ensure that key engineering strategies / philosophies are in place.

Activities / Deliverables		Description	Key Discipline	Supporting Documentation
1	Performance Standards & Verification Scheme	Confirm safety critical systems / elements and set appropriate performance standards. i.e. functionality, reliability and survivability. Develop scheme to allow the independent competent body (ICB) to verify the design against the performance standards.	Technical Safety	Hazard Management Philosophy, OAG-X160-190-GDL-009 (previously A00-97-001); Hazard & Risk Management, OAG-X160-190-PRO-024; Design Verification Activities (under DCR), OAG-X160-190-PRO-028; Platform Safety Case.
2	Document Distribution Matrix	Create formal document distribution matrix to ensure all disciplines & departments receive all necessary design information in a timely manner.	Project Engineering Manager	
3	Structural Integrity Interface	Ensure structural integrity interfaces are identified & visible to Project, e.g. AMEC / Client focal points, Technical Authorities, Independent Verification Bodies, etc.	Structural	
4	Material Selection Report	Report defining the requirements and specifications of necessary material.	Metallurgy	AMEC Corporate Material Engineering Specifications.
5	Hazard Management Plan	Create Hazard Management Plan identifying all key hazards, technical safety activities and the approach to managing Major Accident Hazards (MAH) in the design.	Technical Safety	Hazard & Risk Management, OAG-X160-190-PRO-024; Management of Functional Safety Guideline OAG-X160-190-GDL-004
6	Piping Specifications	Develop / confirm baseline piping specifications, utilising AMEC Corporate specifications where possible.	Piping	AMEC Corporate Piping Specifications.
7	PDMS Calalogues	Ensure PDMS catalogues are populated & available for all affected disciplines, utilising AMEC Corporate data, i.e. CPC, where possible.	Engineering Systems, supported by Piping, Electrical, Instruments, Structural & HVAC	
8	CMSS Philosophy	Develop Control Monitoring and Safety Systems (CMSS) Philosophy covering key instrumentation and control systems e.g. Process Control System (PCS), Emergency Shutdown System (ESD) and Fire and Gas (F&G).	Instruments	

Detail Engineering Design

Phase 3:

Initial Design Development and Hazard Identification

To develop initial design deliverables to Inter Discipline Review (IDC) stage and identify key hazards.

	Activities / Deliverables	Description	Key Discipline	Supporting Documentation
1	HAZID	Perform hazard identification studies, as identified on Engineering Audit Schedule / Technical Safety Events Schedule.	Technical Safety	Project Hazard Identification (HAZID) AOD-92-018; Engineering & Design Reviews, OAG-X160-190-PRO-013.
2	ENVID	Formal assessment of environmental aspects associated with a modification or a change, and to propose prevention or mitigating measures.	Technical Safety	Environmental Impact Identification (ENVID) OAG-X160-190-PRO-121; Engineering & Design Reviews, OAG-X160-190-PRO-013.
3	PFD IDC	Issue Process Flow Diagrams (PFD's) on formal Inter-Discipline Review (IDC).	Process	
4	Shutdown & Blowdown Philosophy	Explain the measures to prevent and control blowdown and how this will be achieved.	Process	
5	P&ID's IDC	Issue Piping & Instrumentation Diagrams (P&ID's) on formal Inter-Discipline Review (IDC).	Process	
6	C&E IDC	Issue Cause & Effects for formal Inter-Discipline Review (IDC).	Process and Instruments	
7	Plot Plans / Layouts IDC	Issue equipment Plot Plans / Layouts on formal Inter-Discipline Review (IDC).	Piping and Layouts	
8	Hazardous Area Layouts IDC	Issue Hazardous Area Layouts for formal Inter-Discipline Review (IDC).	Technical Safety	
9	Equipment List	Create master project equipment list identifying all major items of tagged equipment, e.g. vessels, pumps, motors, generators, hydrocyclones, chemical injection packages, electrical switchgear, control panels, etc.	Mechanical	

Detail Engineering Design

Phase 4:

Initial Design Review & Audit

To confirm that the initial design development is robust/strong.

Activities / Deliverables		Description	Key Discipline	Supporting Documentation
1	Hazardous Area Review	Formal Engineering discipline review of hazardous area layouts to confirm requirements for the correct selection and location of equipment.	Technical Safety	Hazard and Risk Management Procedure QAG-X160-190-PRO-024; Engineering & Design reviews, QAG-X160-190-PRO-013
2	P&ID Review and / or 'Initial Hazop'	Formal Engineering discipline review of P&ID's to confirm design basis.	Process, Piping, Technical Safety, Instruments	Formal Hazop, QAG-X160-190-PRO-017; Engineering & Design Reviews, QAG-X160-190-PRO-013
3	Plot Plans / Layout / 3-D Model Review	Formal Engineering review of Plot Plans / Layouts. The review shall ensure that the layout design complies with the required technical, safety, operability and maintainability standards. Makes sure the layout is cost effective, ensures the constructability of the work and agrees the layout basis on which the detailed design can proceed.	Piping and Layouts, Structural, Mechanical, Electrical, Technical Safety, Process	Engineering & Design Reviews, QAG-X160-190-PRO-013
4	C&E Review	Formal review of Cause & Effects diagrams to confirm design basis and alignment with Hazard Management Plan.	Instruments, Process, Technical Safety	Hazard and Risk Management Procedure QAG-X160-190-PRO-024; Engineering & Design reviews, QAG-X160-190-PRO-013; Management of Functional Safety Guideline QAG-X160-190-GDL-004
5	Technical Audit	Obtain confirmation, by sampling of project documentation, that the engineering of the project is to the required standard and free from errors.	Independent (Corporate Engineering)	Technical Audit Procedure QAG-X160-190-PRO-022

Detail Engineering Design

Phase 5:

Approval for Design (AFD)

To ‘Freeze’ the Process design, and develop dependent design & procurement activities.

	Activities / Deliverables	Description	Key Discipline	Supporting Documentation
1	PUWER Assessments	Conduct initial PUWER assessment typically by review of PDMS model and/or vendor / equipment supplier information received to date.	Technical Safety, Mechanical	Engineering & Design Reviews, OAG-X160-190-PRO-013
2	HAZOP	Hazard and Operability Studies, a systematic multi-discipline study based on the applications of guidewords to identify causes of potential hazards and operability constraints in a facility.	Process, Technical Safety	Dependent on Project updated P&ID's and C&E's may be prepared from commented IDC's from Phase 3 Formal HAZOP, OAG-X160-190-PRO-017 (previously AOD-92-022); Engineering & Design Reviews, OAG-X160-190-PRO-013 - Note: additional HAZOP's may be required, i.e. earlier or later in the project. PEM to consult with Process & Technical Safety Lead Engineers.
3	SHE Audit (AFD)	SHE Audit ensures that the design obligations under The Health and Safety At Work Act 1974 and project health, safety and environmental performance standards are being or have been met during the engineering and design processes.	Technical Safety	SHE Audit Procedure OAG-X160-190-PRO-023; Engineering & Design Reviews, OAG-X160-190-PRO-013
4	Environmental Report	Issue final report to document & confirm that the design has considered all applicable environmental aspects & demonstrates that design controls have been included to minimise / control the environmental impact.	Technical Safety	Engineering & Design Reviews, OAG-X160-190-PRO-013
5	Constructability Review	Conduct formal Constructability Reviews to ensure safe and efficient installation of plant & equipment.	Affected disciplines + Construction / Implementation Group	Engineering & Design Reviews, OAG-X160-190-PRO-014
6	P&ID AFD	Issue Approved For Design (AFD) Process and Instrumentation Diagrams.	Process	

Provision and Use of Work Equipment Regulations 1998 (PUWER)

Detail Engineering Design

Phase 6:

Approval for Construction (AFC)

To ensure that sufficient design information & certification is available to facilitate safe installation, operation & maintenance.

	Activities / Deliverables	Description	Key Discipline	Supporting Documentation
1	SHE Audit AFC	Conduct SHE Audit at AFC stage in accordance with Harmonised Procedure.	Technical Safety	SHE Audit Procedure OAG-X160-190-PRO-023
2	IEC 61511 Compliance Report	Final report to formally demostrate that the Safety Instrumented Systems comply with the requirements of IEC 61511.	Instruments	Management of Functional Safety, OAG-X160-190-GDL-004
3	PFD's AFC	Issue Approved For Construction (AFC) Process Flow Diagrams.	Process	
4	Operational Safety Case Development	Commence operational Safety Case development.	Technical Safety	
5	P&ID's AFC	Issue Approved For Construction (AFC) Process and Instrumentation Diagrams.	Process	
6	Quantative Risk Assessment (QRA)	Complete QRA activities to confirm that the design is robust and complies with legislative requirements.	Technical Safety	
7	C&E AFC	Issue Approved For Construction (AFC) Cause & Effects.	Instruments	
8	Operating Procedures Review / Operational HAZOP	Ensure operating procedures are verified line by line against the facilities provided on the P&ID's.	Process, Technical Safety	Formal HAZOP, OAG-X160-190-PRO-017 (previously AOD-92-022); Engineering & Design Reviews, OAG-X160-190-PRO-013
9	Fabrication Drawings AFC	Issue Approved For Construction (AFC) Piping Isometrics, Structural Steelwork drgs, etc.	Affected Disciplines	
10	Verification of Vendor Information & Certification - Installation, Operation & Maintenance	Verify, primarily through review of vendor documentation, that their design & manufacture of fabricated packages, etc is robust and contains sufficient information to facilitate safe installation, operation & maintenance.	Affected Disciplines	
11	EC Design Examination Certificates	Where AMEC are deemed to be the manufacturer of the piping systems, then under the PED/PER, AMEC have to apply to the Notified Body (NoBo) for an EC Design Examination Certificate (Cat IV assemblies only).	PER Focal point	Project Compliance with the Pressure Equipment Directive, Document No. OAG-X160-190-GDL-007.
12	Declaration of Conformity	Where AMEC are deemed to be the manufacturer of the piping systems, then under the PED/PER, AMEC have to create a Declaration of Conformity, signed by the Project Manager.	Project Manager	Project Compliance with the Pressure Equipment Directive, Document No. OAG-X160-190-GDL-007.

Detail Engineering Design

Phase 7:

Design Close-Out

To ensure all final design deliverables are completed and that client and statutory obligations are satisfactorily resolved.

Activities / Deliverables		Description	Key Discipline	Supporting Documentation
1	Safety Case Acceptance (HSE)	Submit Safety Case to HSE & close out all queries / correspondance prior to next stage of operations.	Technical Safety	
2	Certifying Authority (CA) / Independent Verification Bodies (IVB) Acceptance	Close out all outstanding technical queries and obtain final Letter of Acceptance.	Technical Safety	
3	Complete Project As-Built Documentation	Complete as-builts of design drawings and deliverables in accordance with Project / Client requirements.	Affected Disciplines	As Built Drawings and Documentation, AOD-92-021

G. Technical Specification

TECHNICAL SPECIFICATION INDEX

DIVISION 01 - GENERAL REQUIREMENTS

NO.	SPEC. NO.	TECHNICAL SPECIFICATION TITLE
1.	014529	Testing Laboratory Services

DIVISION 02 - EXISTING CONDITIONS

NO.	SPEC. NO.	TECHNICAL SPECIFICATION TITLE
1.	022113	Site Surveys
2.	024100	Demolition

DIVISION 03 - CONCRETE

NO.	SPEC. NO.	TECHNICAL SPECIFICATION TITLE
1.	032100	Reinforcing Steel
2.	033100	Structural Concrete
3.	033500	Concrete Finishing
4.	036200	Non-shrink Grouting

DIVISION 04 - MASONRY

NO.	SPEC. NO.	TECHNICAL SPECIFICATION TITLE
1.	040513	Masonry Mortaring
2.	042113	Brick Masonry
3.	044300	Stone Masonry

H. Discussion

- Project Lifecycle (residential)
- Find Technical Specification for construction activities (Excavation work, painting work, etc)

On a group (3-4 students)